NASA-CR-203291

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Progress Report

ATMOSPHERIC INFRARED SOUNDER

NASA CONTRACT NAS5-31376

for the period

June 16, 1996 - December 15, 1996

Submitted to Team Leader
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January 16, 1997

Microwave Transmittance

In the rapid transmittance algorithm, the treatment of water vapor channels at 23.8 and 183.3 GHz was modified to take advantage of the wide spacing between water lines, compared to the frequency resolution of microwave instruments. The new approach is to calculate the layer opacity of one nearby line using a Lorentz lineshape, and add to that the far-wing contributions of other lines, using the same approximations as for a window channel. Hence, the algorithm averages opacity over the water-vapor channel passbands, rather than averaging transmittance as in the case of oxygen channels. However, the new algorithm takes self-broadening of the local line into account (unlike the earlier algorithm), and the errors in approximating a full line-by-line calculation are reduced. These errors are plotted in Figure 1 for two values of surface emissivity.

Microwave First-Guess Algorithm

The previous 6-month report described testing of this algorithm with SSM/T and SSM/T2 data. This work continued in the second half of the year with radiosonde matchups. Figure 2 shows comparisons of retrieved temperature and water vapor mixing ratio with a radiosonde launched from Guam. Here the agreement is satisfactory. A more difficult situation, over the Azores, is shown in Figure 3. The radiosonde shows a very strong temperature inversion layer between 850 and 900 mb, which is not retrieved due to the vertical resolution of the SSM/T. The water vapor mixing ratio drops by a factor of 7 in this layer. Between 350 and 500 mb there is another layer in which water vapor changes rapidly. Neither of these steep gradients is retrieved. A paper on these results was presented at the 5th Specialist Meeting on Microwave Radiometry in Boston (Rosenkranz, 1996).

Algorithm Theoretical Basis Document

Sections 3.1 and 4.1 of the AIRS ATBD describe the above two algorithms.

AIRS/AMSU Cloud Clearing Alrogithm

Work has been done to improve the performance of the neural net retrieval algorithm in cases of extreme cloud cover and/or troublesome surface conditions (e.g. large perturbations in surface emissivity, elevated terrain, etc.).The approach has been to try to separate the effects of clouds and surface conditions, and deal with them separately in the algorithm. A perturbation profile due to clouds is generated, as well as a perturbation profile due to the surface. (Perturbation profile = estimated deviation from the mean profile). These perturbation profiles are then used by a neural net cloud-clearing algorithm to estimate the final (45 km resolution) profile.

Improvements of ~0.05 K-0.15K in overall temperature retrieval accuracy have been made. Further improvements are expected when spatial filtering (along the tracks) is used. This update to the algorithm is presently being developed.

Other work involves the development of a microwave scattering model for the AMSU A/B frequencies, and an improved statistical model for cloud topography.

References

P.W. Rosenkranz, "Retrieval of Atmospheric Moisture Profiles from SSM/T2 Measurements," presented at 5th Specialist Meeting on Microwave Radiometry and Remote Sensing of The Environment, Boston, MA, 4-6 Nov. 1996.

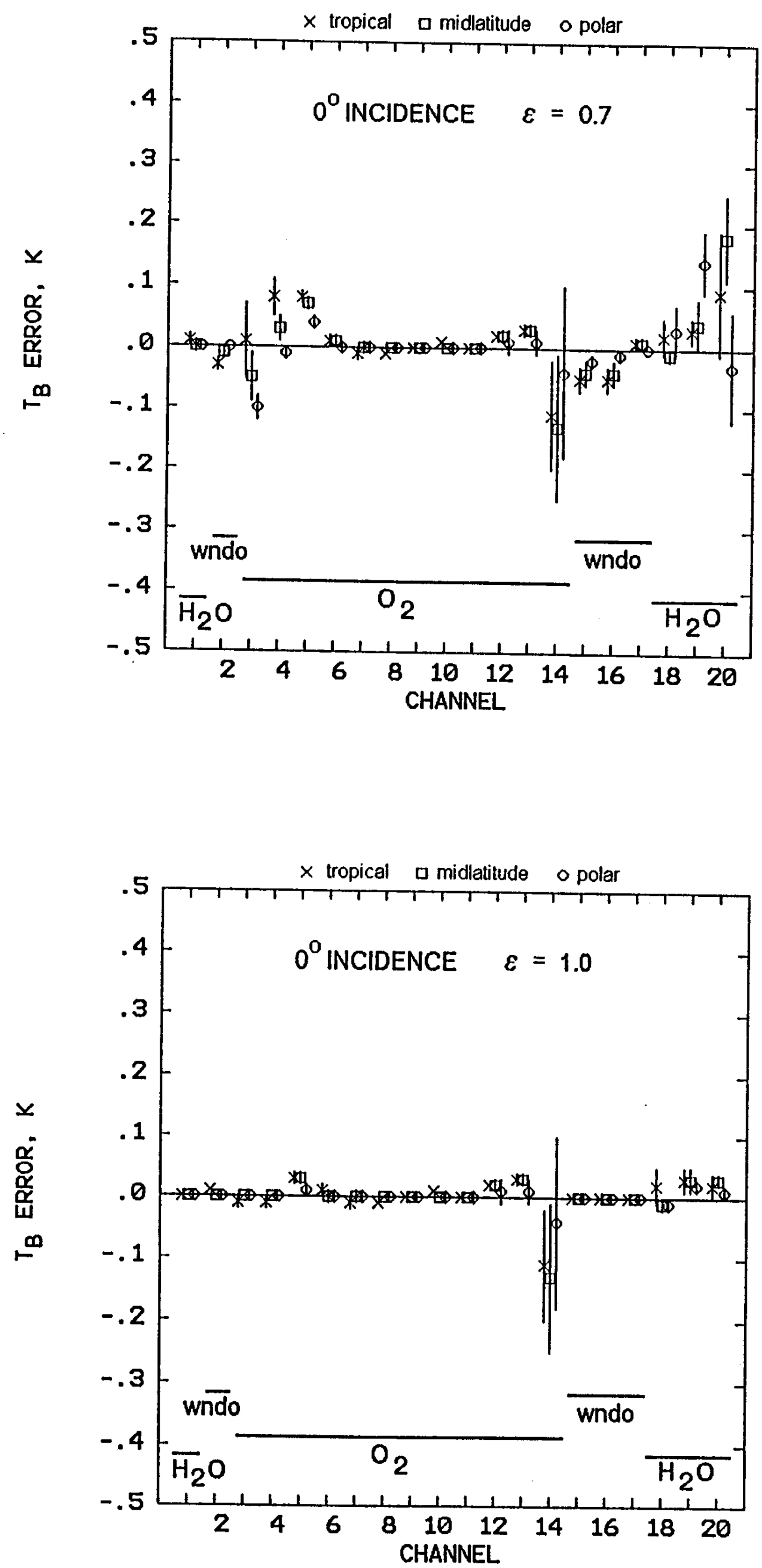
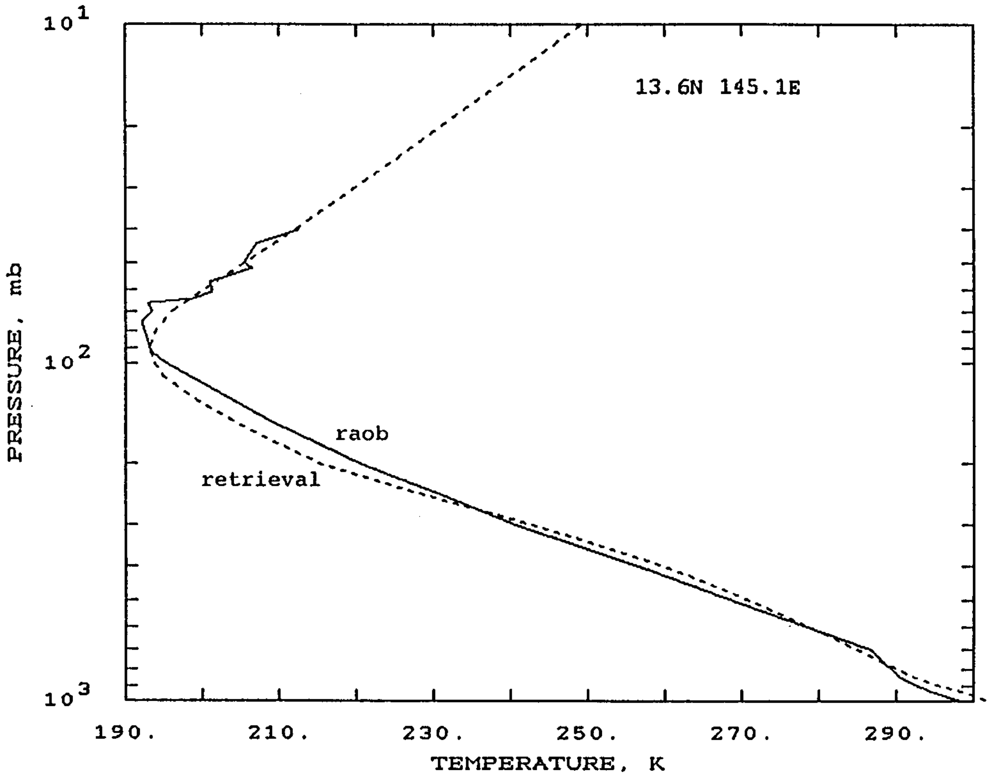


Figure 1. Brightness temperature errors (rapid algorithm minus line-by-line algorithm) for AMSU-A, -B channels. Vertical lines indicate ±1 standard deviation.



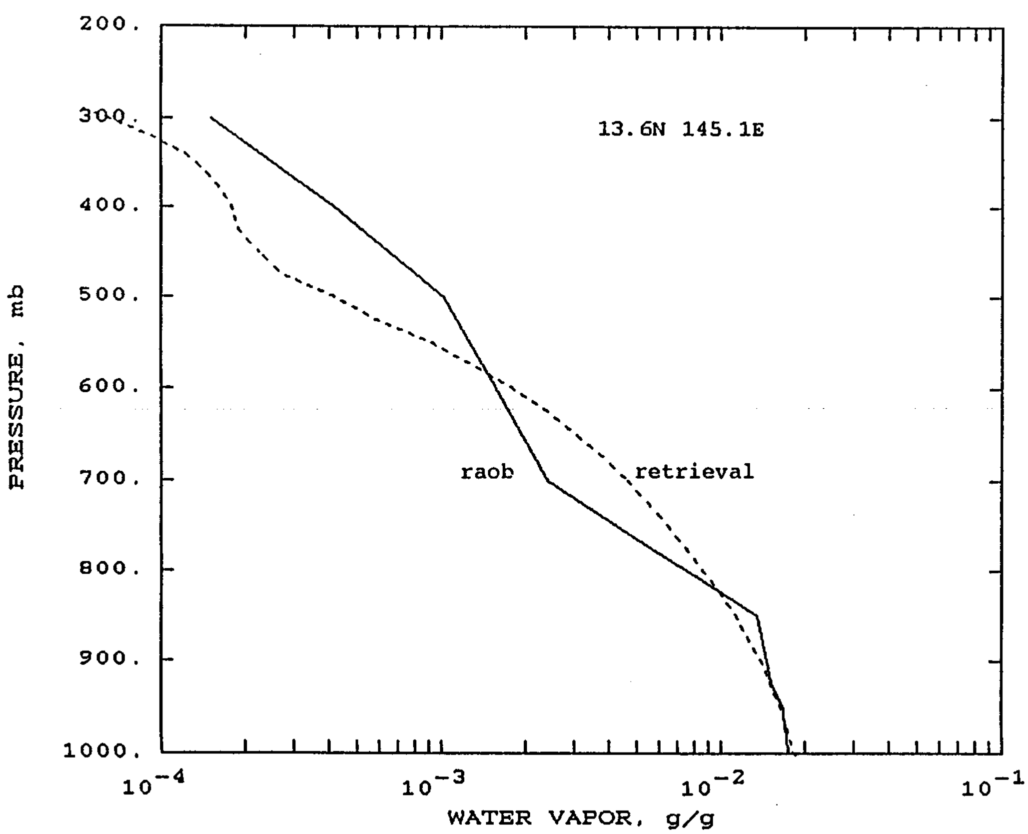
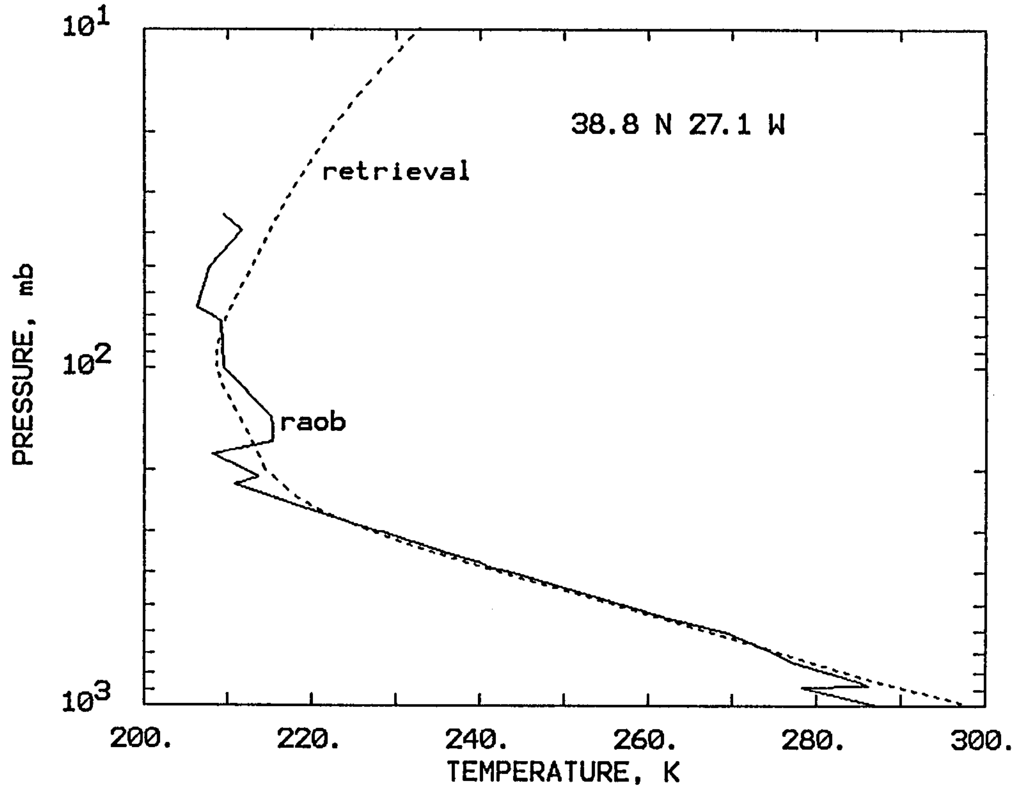


Figure 2. Retrieved and *in-situ* measurements of temperature and water vapor from Guam, on Jan. 15, 1993.



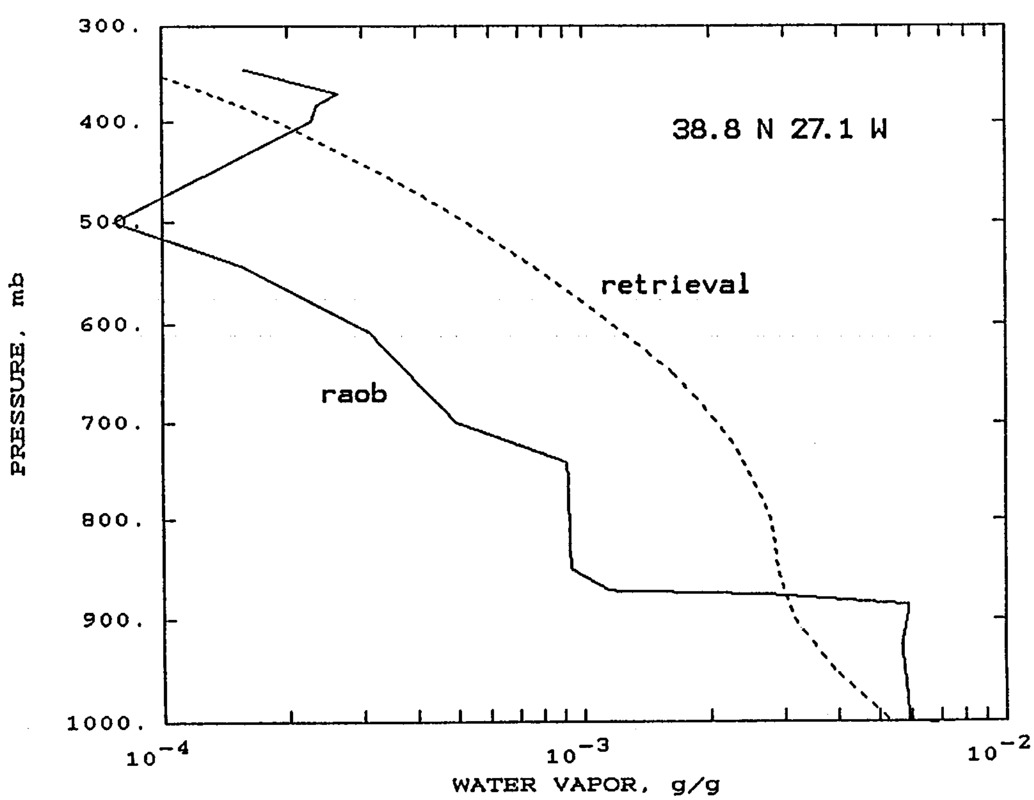


Figure 3. Retrieved and *in-situ* measurements of temperature and water vapor from the Azores, on Jan. 15, 1993.

Report Documentation Page

NASA
National Aeronautics and Space Administration

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.

4. Title and Subtitle	5. Report Date
Atmospheric Infrared Sounder	Jan. 13, 1997
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
P.W. Rosenkranz and D.H. Staelin	10. Work Unit No.
9. Performing Organization Name and Address Massachusetts Institute of Technology Research Laboratory of Electronics Cambridge, MA 02139-4307	11. Contract or Grant No. NAS5-31376
	13. Type of Report and Period Covered Semiannual 6/16/96 - 12/15/96
12. Sponsoring Agency Name and Address NASA/Goddard Space Flight Center Greenbelt, MD 20771	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report summarizes the activities of AIRS Team Members P.W. Rosenkranz and D.H. Staelin during the second half of 1996.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
AIRS, AMSU, MHS	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of pages	22. Price
Unclassified	Unclassified	5	

NASA FORM 1626 OCT 86